

**EPA**United States Environmental Protection Agency  
Washington, DC 20460**Work Assignment**

Work Assignment Number

3-03

☐ Other ☐ Amendment Number:

Contract Number

EP-D-14-031

Contract Period 10/01/2014 To 09/30/2018

Base

Option Period Number 3

Title of Work Assignment/SF Site Name

UPDATE BENMAP-CE TOOL

Contractor

INDUSTRIAL ECONOMICS, INCORPORATED

Specify Section and paragraph of Contract SOW

Purpose:



Work Assignment



Work Assignment Close-Out



Work Assignment Amendment



Incremental Funding



Work Plan Approval

Period of Performance

From 10/01/2017 To 09/30/2018

Comments:

THE PURPOSE OF THIS ACTION IS TO INITIATE WA 3-03 "UPDATE BENMAP-CE TOOL" FOR AN INITIAL LOE OF 200 HOURS FOR START UP WORK. ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED. THIS WORK DOES NOT DUPLICATE ANY WORK PREVIOUSLY PERFORMED UNDER MY AUTHORITY.



Superfund

## Accounting and Appropriations Data



Non-Superfund

SFO  
(Max 2)

Note: To report additional accounting and appropriations data use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

## Authorized Work Assignment Ceiling

Contract Period:

Cost/Fee:

LOE:

10/01/2014 To 09/30/2018

This Action:

Total:

## Work Plan / Cost Estimate Approvals

Contractor WP Dated:

Cost/Fee

LOE:

Cumulative Approved:

Cost/Fee

LOE:

Work Assignment Manager Name Neal Fann

Branch/Mail Code:

Phone Number: 919-541-0209

FAX Number:

(Signature)

(Date)

Project Officer Name Lorraine Reddick

Branch/Mail Code:

Phone Number: 202-564-1293

FAX Number:

(Signature)

(Date)

Other Agency Official Name

Branch/Mail Code:

Phone Number:

FAX Number:

(Signature)

(Date)

Contracting Official Name Andrew Flynn

Branch/Mail Code:

Phone Number: 919-541-2674

FAX Number: 919-541-0611

(Signature)

(Date)

**I. TITLE: Incorporating New Features and Addressing Bugs in the BenMAP-CE Tool**

**II. WORK ASSIGNMENT MANAGER (WAM):**

Neal Fann  
EPA, OAQPS, OAR  
C539-07  
RTP, NC 27711  
919-541-0209

**III. LEVEL OF EFFORT:**

Hours :

Duration: 12 months (October 1, 2017 to September 30, 2018)

**IV. BACKGROUND:**

In 2003 the U.S. EPA contracted with a developer to create version 1.0 of the environmental Benefits Mapping and Analysis Program (BenMAP). That tool systematized a number of the steps of a health impact and benefits analysis that had previously been performed using the Criteria Air Pollutant Modeling System (CAPMS). Subsequent versions of BenMAP incorporated a number of new features, including a database that could be modified by end-users, more spatially resolved baseline health data and a broader array of health impact functions. The U.S. EPA has used BenMAP to estimate the avoided human health impacts and economic benefits of a number of air quality policies, including the 2002 Non-Road Diesel rule, the 2004 Clean Air Interstate Rule, and the 2011 Mercury and Air Toxics rules, among many others. Over 50 researchers have published over 25 journal articles using BenMAP.

Beginning in 2011, the U.S. EPA began redeveloping the tool from the ground-up to meet two goals: (1) create an open-source software platform so that anyone could see the software code and improve the program; (2) improve the performance, accessibility, capabilities and usability of the software. In the Fall of 2013, after iterating through dozens of beta versions, the U.S. EPA released version 1.0 of the environmental Benefits Mapping and Analysis Program—Community Edition (BenMAP-CE). In the winter of 2015, the Agency released version 1.1 of the software, which addressed a number of bugs identified in version 1.0 and incorporated several new features designed to make it easier for non-U.S. analysts to apply the program.

Under work assignment 2-09, the Contractor made significant progress in addressing bugs that affected the user experience or affected the reliability of the results. Under this work assignment, the Contractor shall address remaining bugs,

develop an interim build of the multi-pollutant version of the BenMAP-CE tool and incorporate new reporting features.

## **V. STATEMENT OF WORK (SOW):**

The Contractor shall conduct the following tasks in accomplishing the objective of this Work Assignment.

### **Task 1: Develop a work plan and project plan**

The Contractor shall develop a new work plan and update the system design document as described below.

#### **Task 1.a: Develop work plan and administer project**

Within 20 calendar days of the effective date of this WA, the Contractor shall submit a work plan to the Work Assignment Manager (WAM). The Contractor shall arrange and conduct an initial phone conference with the WAM within one week of the WAM approving the WA. Subsequent to this initial teleconference, the Contractor shall lead regular phone conferences on at least a weekly basis to discuss work progress and any issues associated with the work tasks. The Contractor shall prepare an agenda for such weekly meetings, record meeting minutes, and distribute such meeting minutes to all participants.

#### **Task 1.b: Update the system design document**

The Contractor, consulting with the WAM, shall develop a comprehensive and detailed project plan for each task in this WA, specifying clearly the technical and functional basis for the new version:

- The minimum design characteristics of the new software
- A workflow describing the expected inputs and outputs of each new program algorithm, including example use cases.
- Desired behavior of graphical the graphic user interface, including sketches of windows, location of hover text, etc.
- Protocol for quality assuring each new feature.
- Sequence in which the Contractor will address the tasks below.

The Contractor shall not modify the source code until the WAM approves this project plan. The Contractor shall develop the system design document for each new BenMAP-CE feature on a rolling basis and in consultation with the Work Assignment Manager.

### **Deliverables:**

- 1.1. Work plan
- 1.2. System design document

## **Task #2: Develop scoping reports for multi-pollutant BenMAP-CE and new reporting features**

### **2a. Multi-pollutant scoping memo**

Under EP-W-11-029, RTI, Inc. developed an alpha build of the Multi-Pollutant BenMAP-CE. This new version was capable of incorporating health impact functions that specify interaction terms and quantify uncertainty using a variance/co-variance matrix. However, as described in a memorandum addressed to IEC on June 14 2017, this version suffers from a number of bugs that prevent users from successfully completing an analysis. Under this work assignment, the Contractor shall develop a scoping memo recommending a least-cost approach to developing a rudimentary and operational version of the software that is capable of generating results using effect coefficients reported in the Winquist et al. (2014) epidemiological study for Atlanta. When developing this memorandum, the Contractor shall consult: (1) the bugs identified in that memo; (2) the R code provided to IEC that describes the correct calculation of multi-pollutant health impact functions and the confidence intervals around those estimates; (3) the BenMAP-CE code posted to the GitHub repository. The memorandum shall provide to EPA a list of options for completing the code, categorized according to level of effort and quality of end product.

### **2b. Reporting scoping memo**

Under work assignment EP-D-14-032, WA 2-25, the Contractor explored the feasibility of using the open source Oxyplot plotting library in BenMAP-CE. Under this work assignment, and in consultation with the WA-COR, the Contractor shall identify 2-3 use cases in the BenMAP-CE program for Oxyplot. Upon identifying these use cases, the Contractor shall develop a level of estimate to incorporate these changes into the BenMAP-CE code.

#### **Deliverables:**

- 2.1 Draft memorandum
- 2.2 Final memorandum

## **Task #3: Address bugs and improve functionality of the BenMAP-CE tool**

### **3a. Address bugs identified in JIRA**

The Contractor shall address the bugs identified in JIRA Sprint #1 and Sprint #2. After addressing each group of issues within each Sprint and confirming that these bugs have been resolved in a new test build, the Contractor shall provide a build of the program to the WA-COR. After completing

Sprint #2, the Contractor and WA-COR shall identify jointly the remaining bugs that should be assigned to the next Sprint.

### **3b. Develop multi-pollutant version of the BenMAP-CE program**

Pending the results of task 2a, the Contractor shall develop a multi-pollutant version of the program. This new version of the program shall at minimum quantify first-order interactions of pollutants using the effect coefficients in the Winquist et al. (2014) article for the city of Atlanta. Users should be able to specify new health impact functions and pollutant groupings. The Contractor and the WA-COR shall evaluate the validity of the results together using existing R code.

### **3c. Incorporate new reporting features**

Pending the results of task 2b, the Contractor shall incorporate a new reporting feature into BenMAP-CE. Potential report types could include heat maps, box and whisker plots, pie charts and line graphs.

#### **Deliverables:**

3.1 Address bugs

3.2 Multi-pollutant BenMAP-CE

3.3 New reports

### **4. Develop a manuscript for peer review that documents the PopSim tool**

The Contractor shall complete the draft manuscript developed under a previous work assignment that describes the key features of the PopSim tool. In particular, the revised version of the manuscript shall outline the input data, the algorithms used to quantify changes in life years and life expectancy, and the appropriate interpretation of the results. The manuscript shall also include a proof-of-concept analysis that uses PopSim generated results to calculate the Present Value of an illustrative air quality management policy.

## **VI. REPORTING REQUIREMENTS:**

All reports shall be in accordance with contract specifications. The Contractor shall submit work products in electronic as well as hard copy form. In addition, the Contractor shall deliver to the WAM each draft and final report in electronic format that is readable by OAQPS's windows-based word-processing (Microsoft Word 2007), graphics (Microsoft PowerPoint 2007), spreadsheet (Excel 2007), and database (Access 2007) programs.

## **VI. QA Requirements:**

The Contractor shall include a quality assurance section in the final report discussing the data used with respect to precision, accuracy, representativeness, comparability, completeness, sensitivity and appropriateness as it applies to this use and its source. The QA section will discuss how the Contractor ensured that the environmental data were of acceptable quality and that they were being used for the purpose for which they were collected.

#### **VIII. DELIVERABLES:**

The Contractor shall adhere to the following schedule:

<b>Task</b>	<b>Deliverable</b>	<b>Delivery Schedule</b>
1a	Cost estimate	20 days after effective date of WA
1b	System design document	Ongoing
2a	Multi-pollutant scoping memo	2 months after the effective date of the WA
2b	Reports scoping memo	3 months after the effective date of the WA
3a	Address bugs	4 months after the effective date of the WA
3b	Multi-pollutant BenMAP-CE	5 months after the effective date of the WA
3c	New reports	6 months after the effective date of the WA